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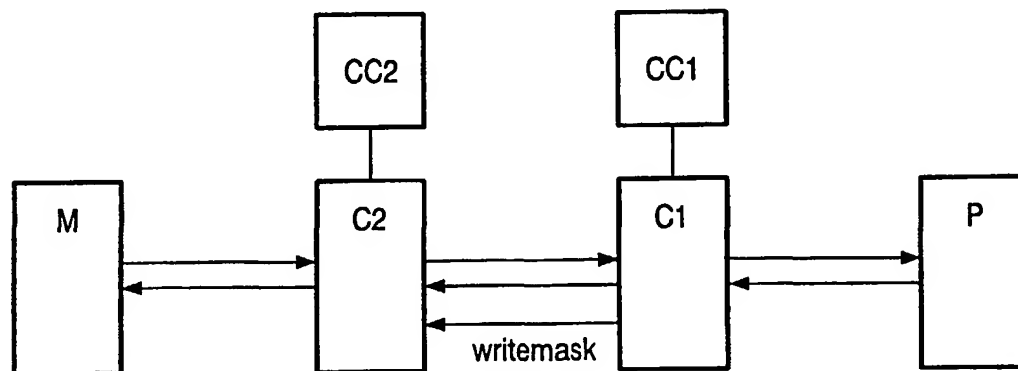
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[Continued on next page]

(54) Title: DATA PROCESSING SYSTEM HAVING A HIERARCHICAL MEMORY ORGANISATION AND METHOD FOR OPERATING THE SAME



(57) Abstract: A data processing system according to the invention comprises a processor (P) and a memory hierarchy. The highest ranked level therein is a cache coupled to the processor. The memory hierarchy comprises a higher ranked cache (C1) having a cache controller (CC1) operating according to a write allocate scheme, and a lower ranked cache (C2) is coupled to the higher ranked cache (C1) having a cache controller (CC2). The size of the higher ranked cache is smaller than the size of the lower ranked cache. Both caches (C1, C2) administrate auxiliary information (V1, V2) indicating whether data (D1, D2) present therein is valid. The linesize of the lower ranked cache (C2) is an integer multiple of the linesize of the higher ranked cache (C1). The auxiliary information (V1) in the higher ranked cache (C1) concerns data elements (D1) at a finer granularity than that in the lower ranked cache (C2). The higher ranked cache (C1) is arranged for transmitting a writemask (WM) to the lower ranked cache (C2) in conjunction with a line of data (DL) for indicating which data in the lower ranked cache (C2) is to be overwritten at the finer granularity. Fetching a line from the next lower ranked level (M) is suppressed if the writemask (WM) indicates that the line (DL) provided by the higher ranked cache (C1) is entirely valid in which case, the controller (CC2) of the lower ranked cache allocates the cache line in the lower ranked cache (C2) without fetching it.



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B. FIELDS SEARCHED

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 307 477 A (NGO HUY X ET AL) 26 April 1994 (1994-04-26) cited in the application column 3, line 22 - column 4, line 4 column 12, line 21 - line 64	1-6
A	US 6 374 330 B1 (ARIMILLI RAVI KUMAR ET AL) 16 April 2002 (2002-04-16) column 4, line 44 - column 6, line 4	1-6

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5307477	A	26-04-1994	US 5542062 A US 5699551 A	30-07-1996 16-12-1997
US 6374330	B1	16-04-2002	CN 1196530 A ,C JP 10301849 A US 6021468 A	21-10-1998 13-11-1998 01-02-2000